



This presentation is from Ampt's participation in a panel discussion at:
Solar Asset Management – North America

Session 7A – Repowering: What Is It and How Does It Impact the Bottom Line?



13-14 March 2018 - San Francisco



Innovative DC Power Management

Lower cost and higher performing PV systems



Optimize PV Systems



Repower PV Systems



DC-Coupled Storage



Monitoring and O&M

Repowering and the emerging role of Solar Asset Management

Repowering and the emerging role of Solar Asset Management

Traditional Role

Activities

Monitor

- Alert setup / response
- Data analysis / insights
- Issue identification
- Reporting
- Forecasting

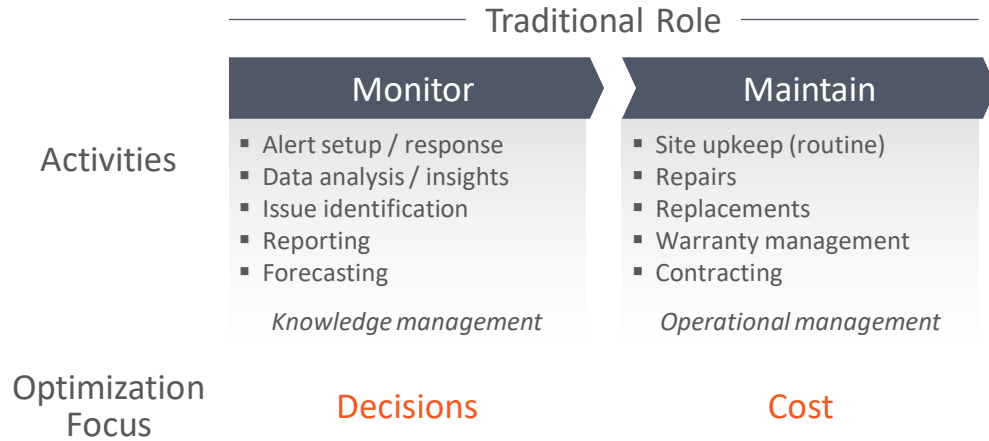
Knowledge management

Maintain

- Site upkeep (routine)
- Repairs
- Replacements
- Warranty management
- Contracting

Operational management

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Optimization Focus

Decisions

Cost



Challenges & Constraints for Repowering

- Limited visibility
- Lack of granular control

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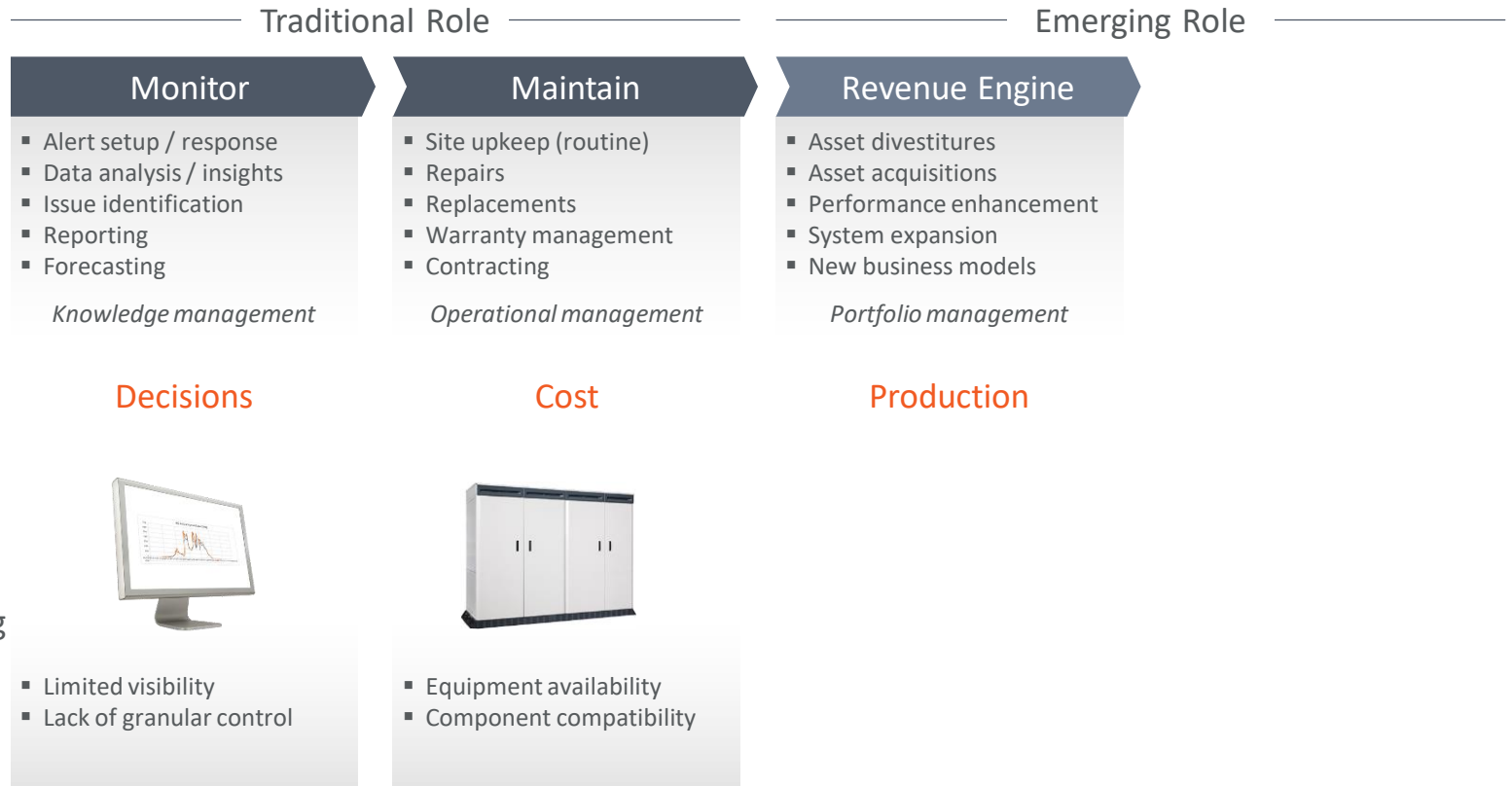


Challenges & Constraints for Repowering

- Limited visibility
- Lack of granular control

- Equipment availability
- Component compatibility

Repowering and the emerging role of Solar Asset Management



Repowering and the emerging role of Solar Asset Management

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Emerging Role

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Maintain

Revenue Engine

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Operational management

- Asset divestitures
- Asset acquisitions
- Performance enhancement
- System expansion
- New business models

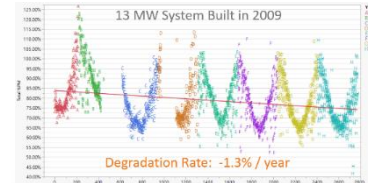
Portfolio management

Optimization Focus

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Production



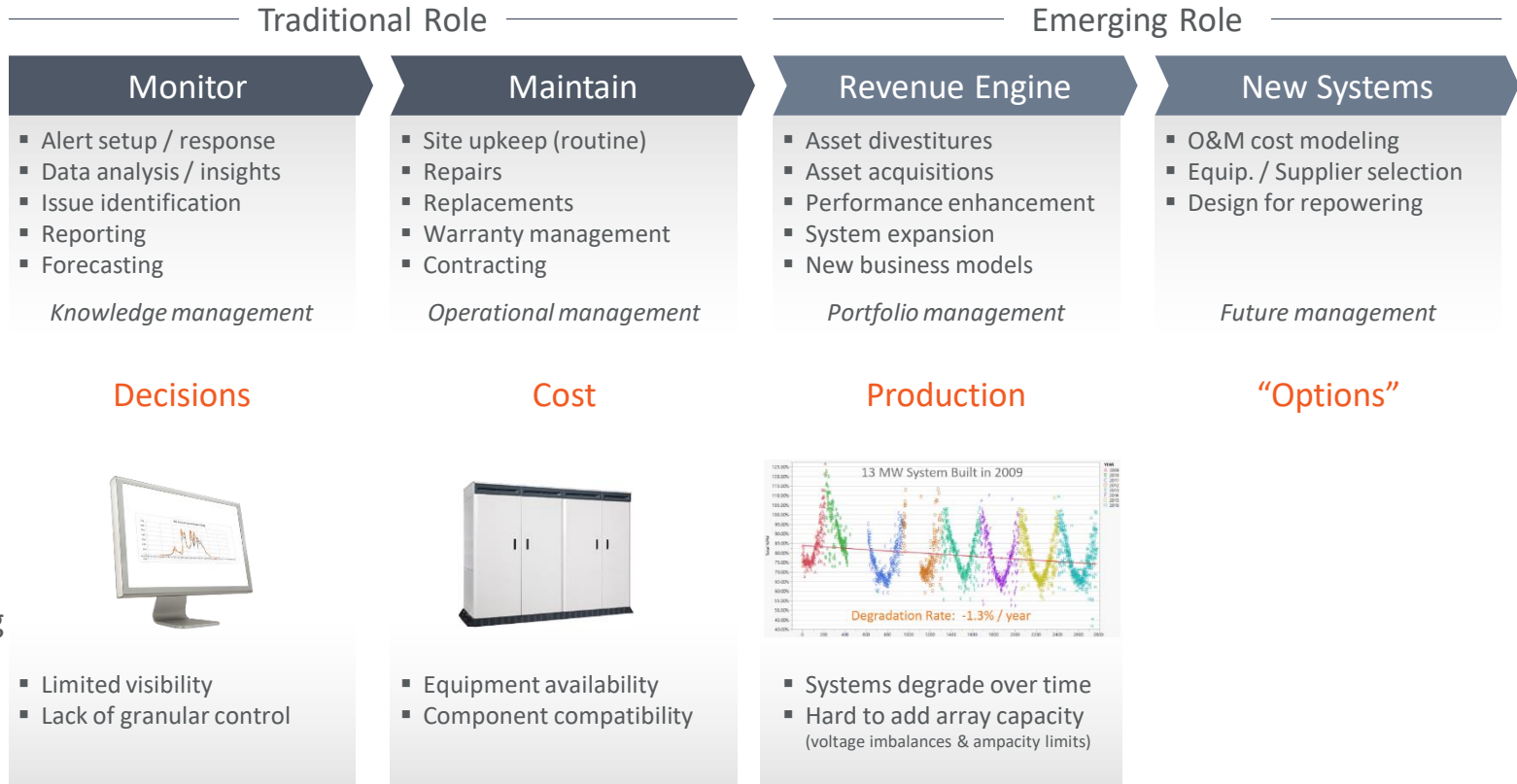
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- Limited visibility
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- Equipment availability
- Component compatibility

- Systems degrade over time
- Hard to add array capacity (voltage imbalances & ampacity limits)

Repowering and the emerging role of Solar Asset Management



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Portfolio management

- O&M cost modeling
- Equip. / Supplier selection
- Design for repowering

Future management

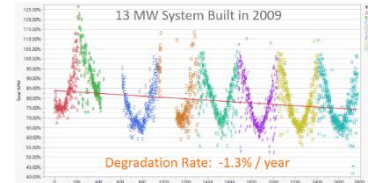
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Production

“Options”



Challenges & Constraints for Repowering

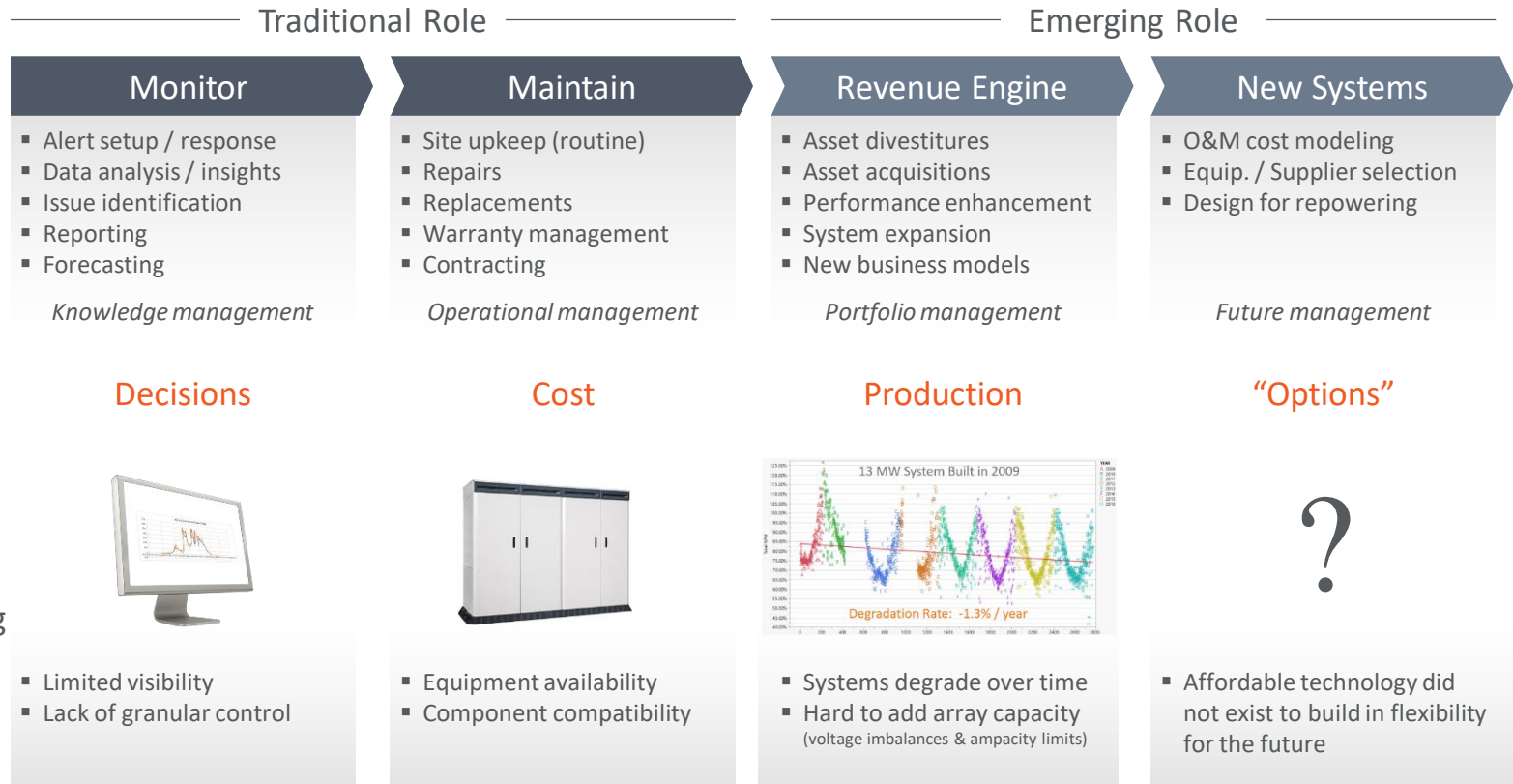
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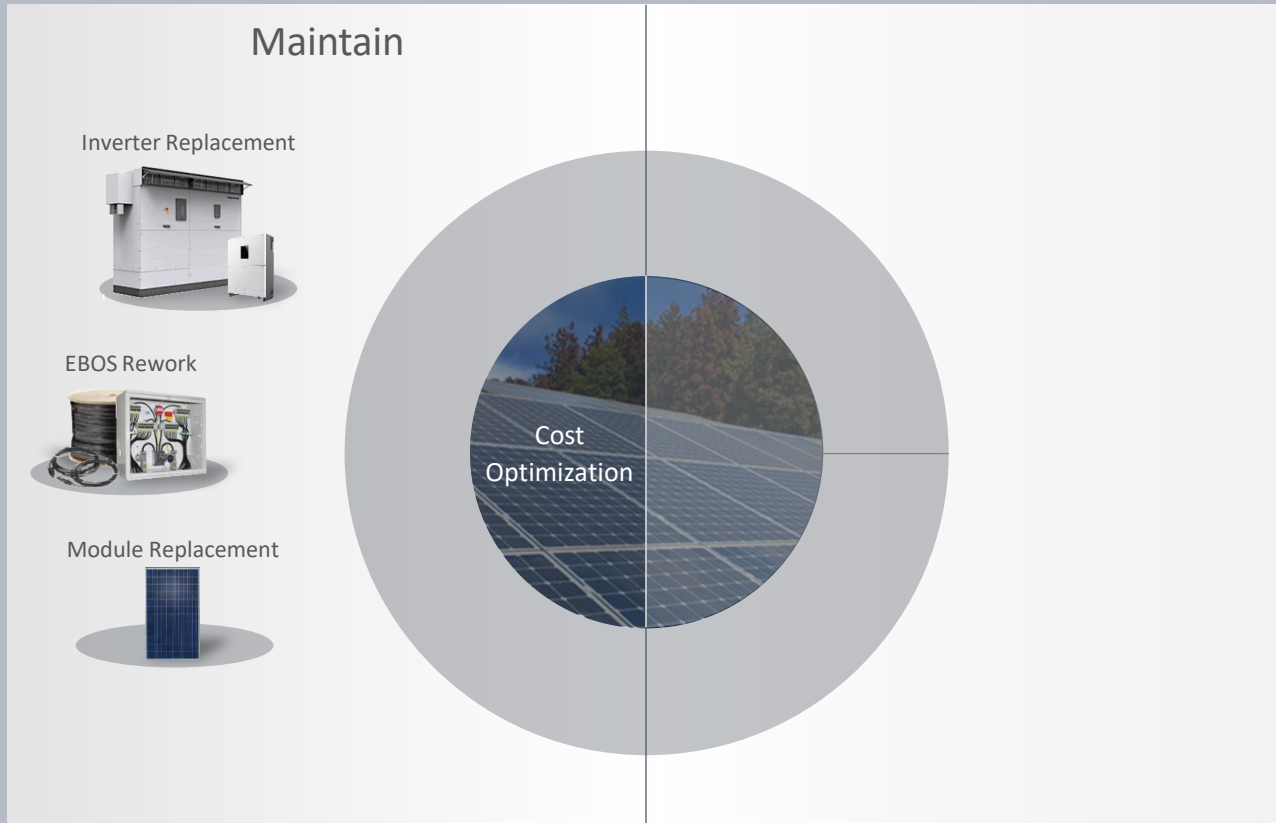
- Affordable technology did not exist to build in flexibility for the future

Repowering and the emerging role of Solar Asset Management

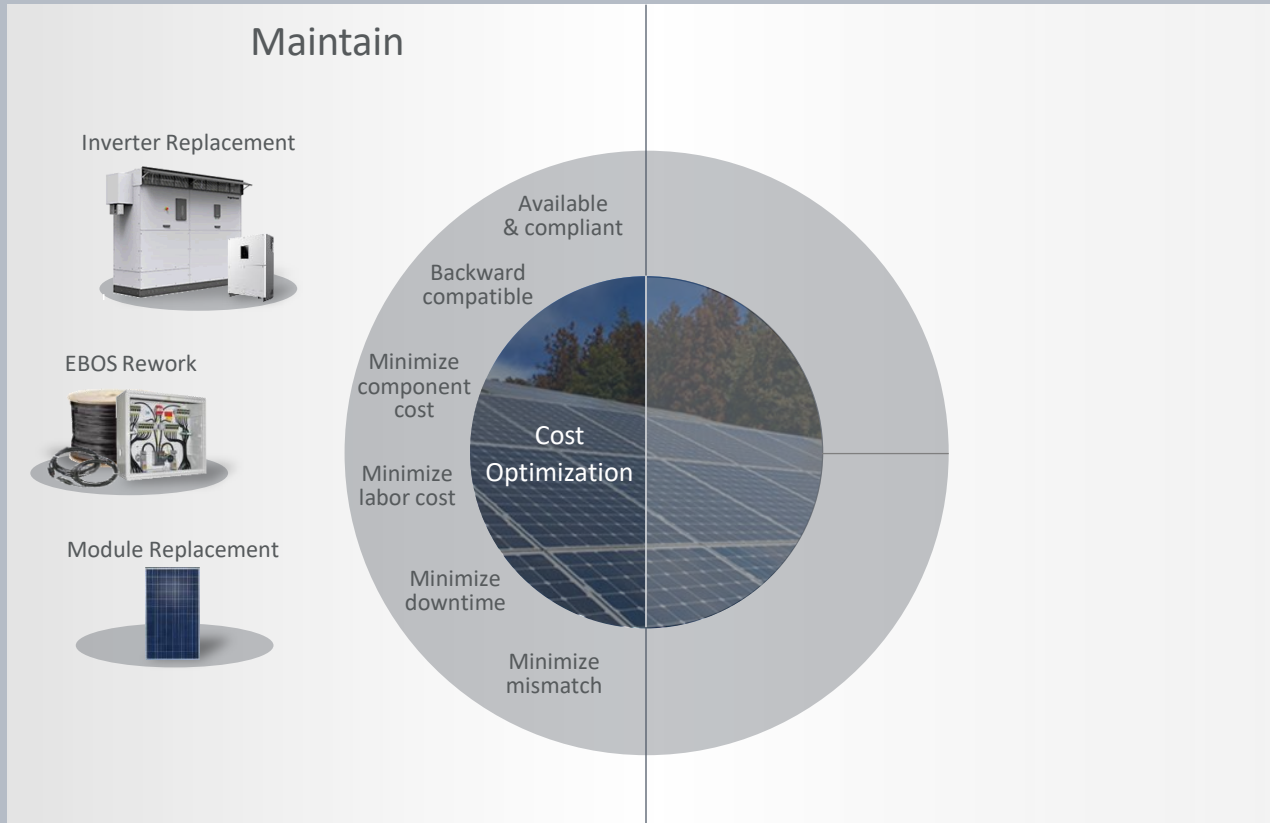


Technology is evolving to meet emerging Repowering opportunities

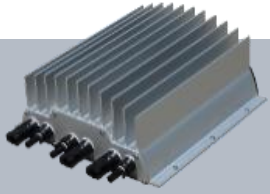
Repowering advantages using DC Power Management



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Repowering advantages using DC Power Management



Maintain

Use modern inverters:

- Lower cost/W; more efficient
- 1000V inverters in 600V systems
- 1500V inverters in 1000V systems
- Use central inverters
- Use string inverters as “virtual centrals”

Inverter Replacement



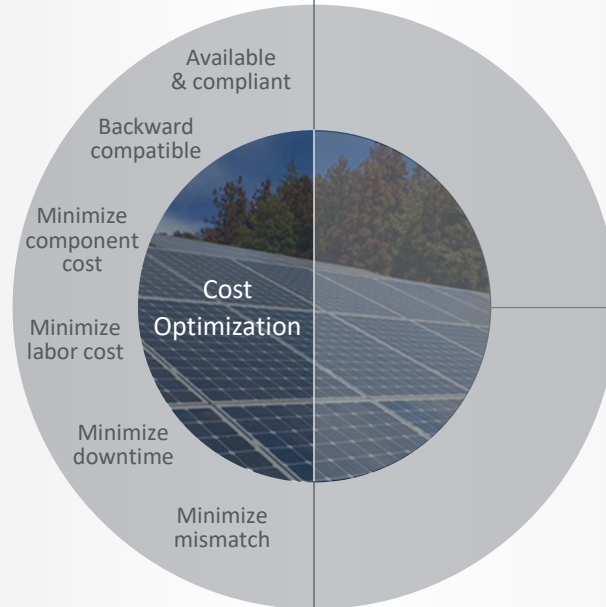
Leverage existing EBOS

- Use existing DC cables
- Use existing combiners
- No retrenching

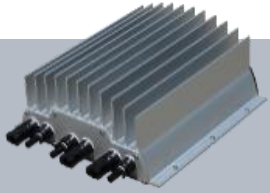
EBOS Rework



Module Replacement



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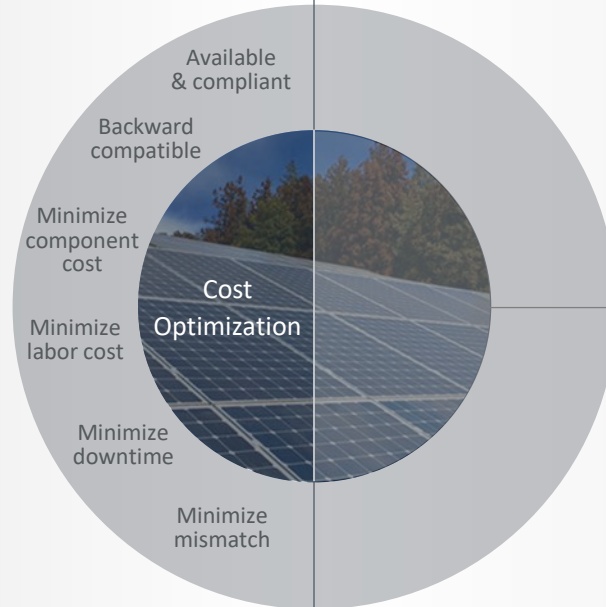
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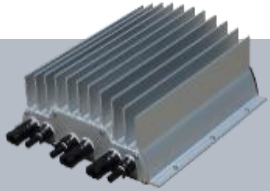
MPPT on every string

- Mix old & new strings
- Flexible inventory

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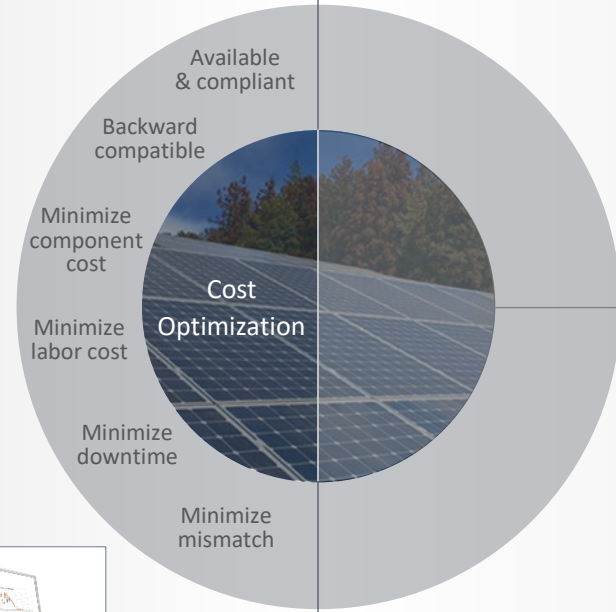
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Module Replacement



String-level communication

- Improved O&M
- Programmable outputs (future-proofing)



Available & compliant

Backward compatible

Minimize component cost

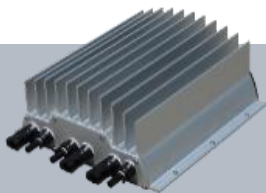
Minimize labor cost

Minimize downtime

Minimize mismatch

Cost Optimization

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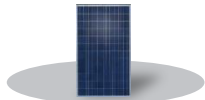
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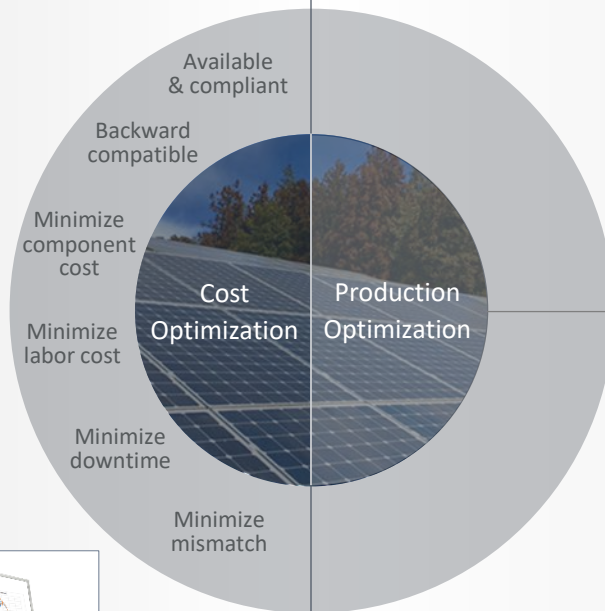


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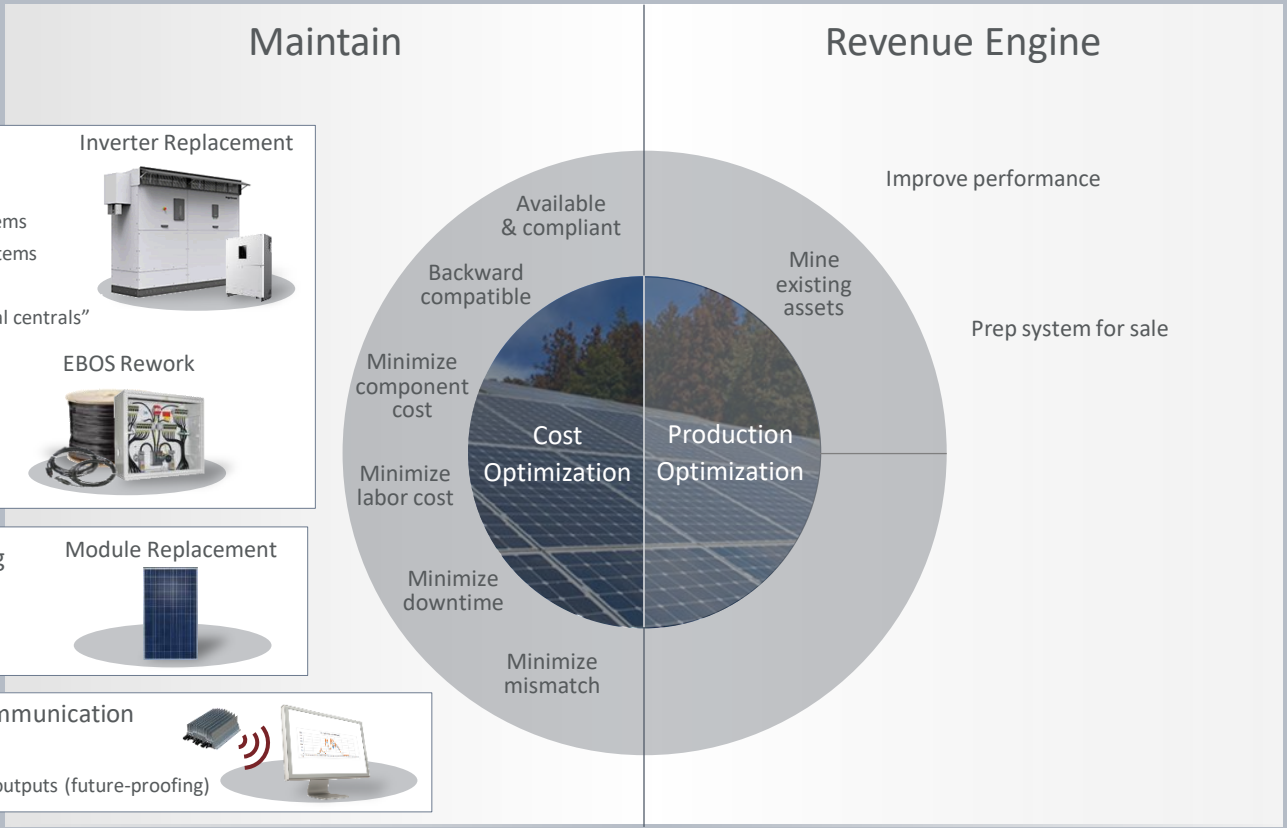
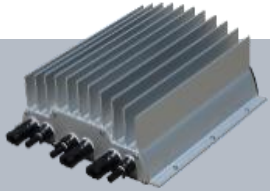
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Revenue Engine



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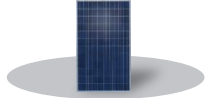
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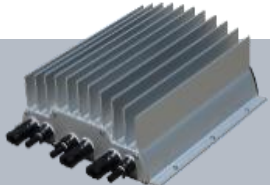


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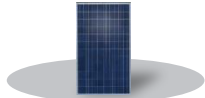
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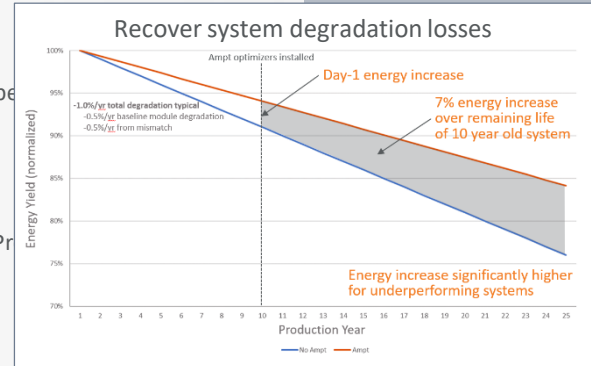
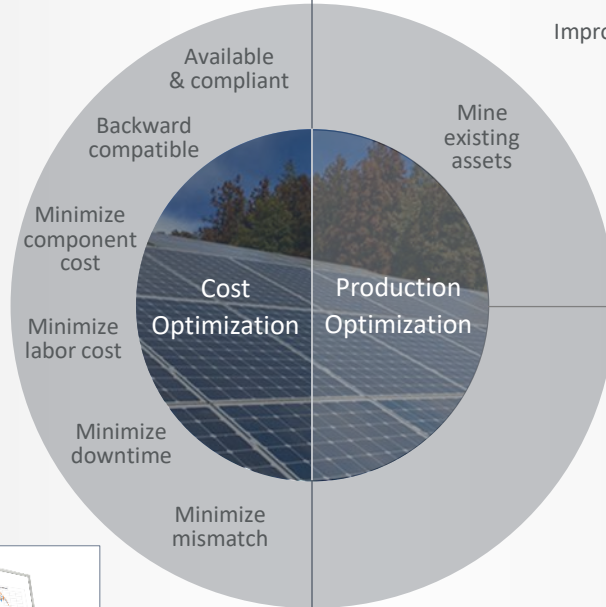


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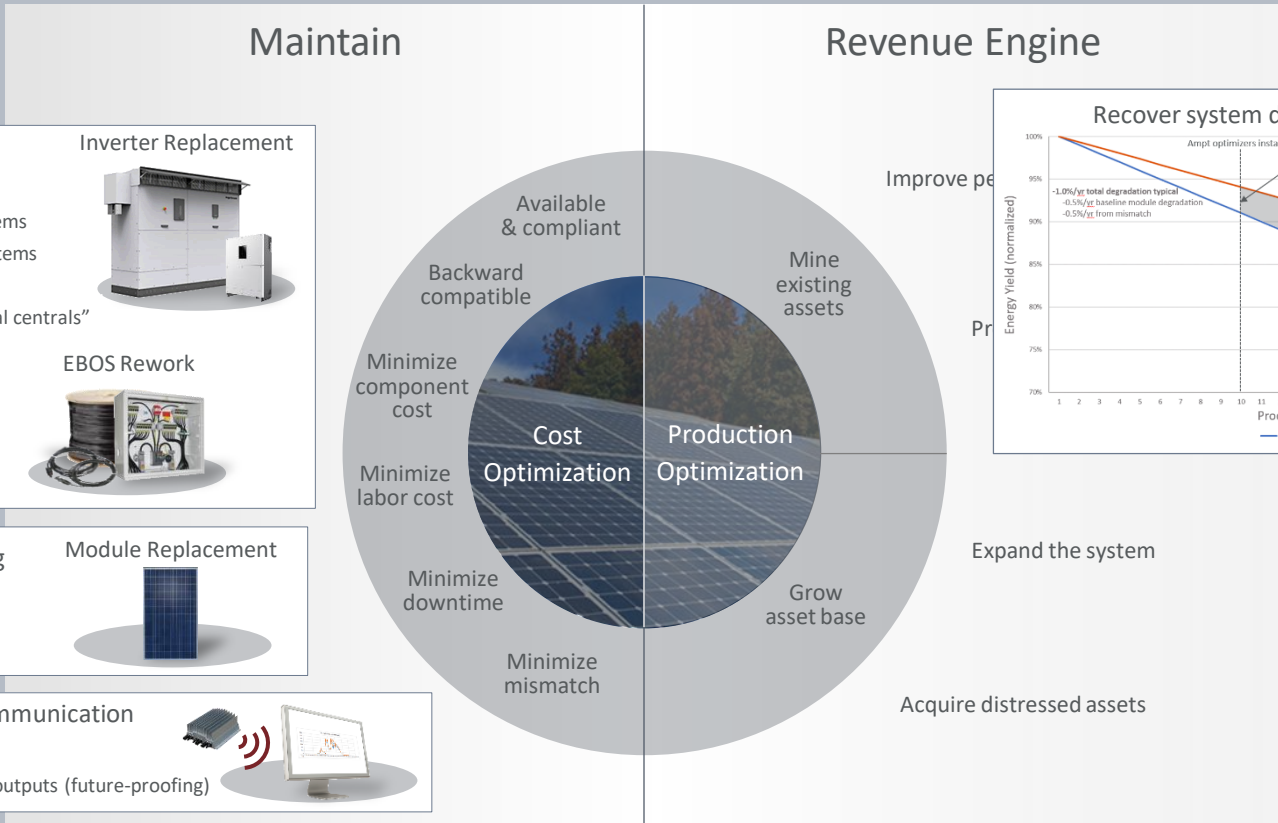
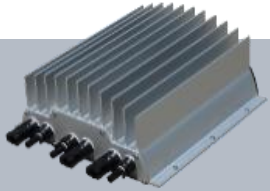
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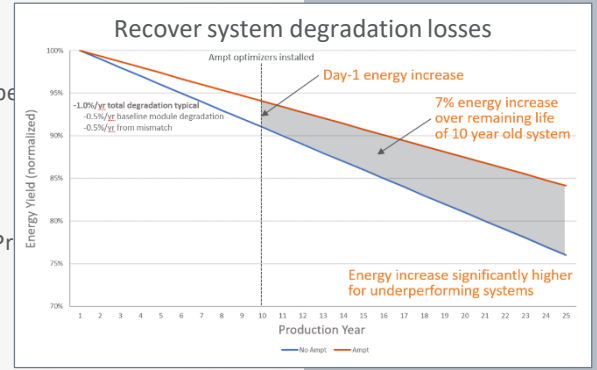
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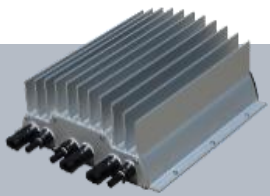
Improve pe

Pr

Expand the system

Acquire distressed assets

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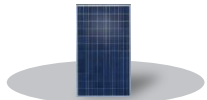
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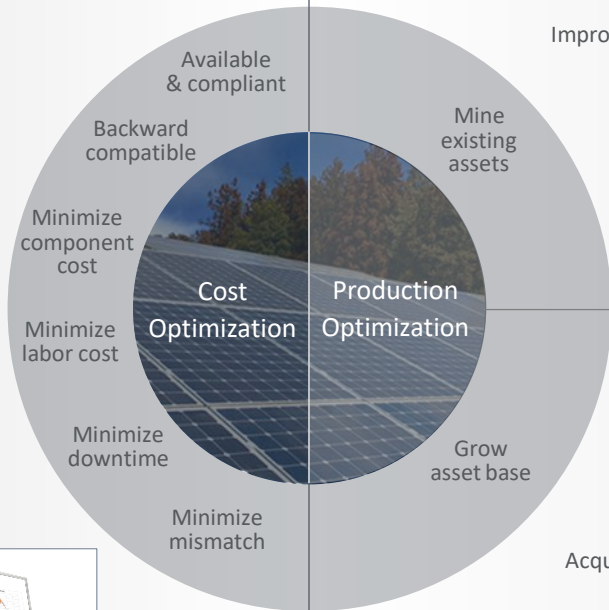


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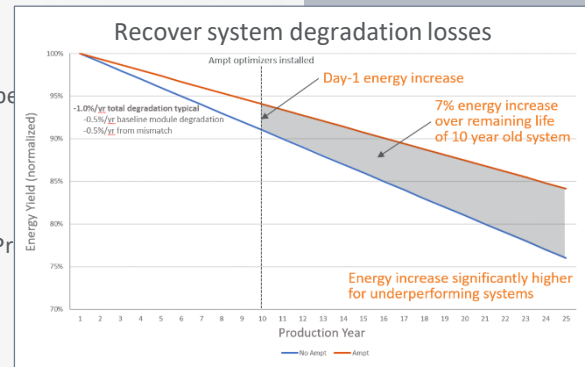
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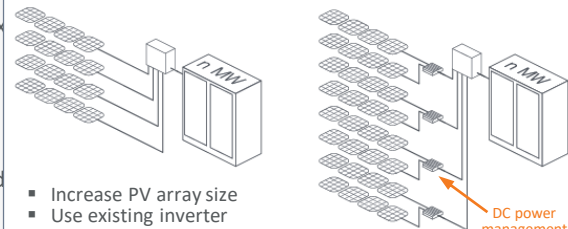


Improve performance



Example

High DC/AC ratios (>2:1)



Acquire d

- Increase PV array size
- Use existing inverter
- Use existing combiners and cables
- Mix new and legacy modules

Repowering: What is it and how does it impact the bottom line?

- The roles of SAMs and repowering are expanding
- Innovative technology is enabling new opportunities
- Repowering has emerged as a revenue engine (vs. cost)
- Develop a vision for “Portfolio” and “Future” management
- Build in flexibility – options have value
- New systems can be designed for repowering while lowering upfront system cost using DC power management

